Control Technology Rankings

History:

- At the April Boiler WG meeting, EPA presented preliminary control technology rankings and boiler counts.
- After the April meeting, the Boiler WG reduced the list of control devices to evaluate by eliminating controls not applicable to boilers. The remaining control devices were given a ranking of 1 to 4, with 1 being the highest level of control and 4 indicating very little emissions reductions.
- During July 1 and July 14 Control Technology Task Group teleconferences, the current control technology methodologies were established.

Current Status:

• Tables I-1, I-2, and I-3 present the latest control technology assessments. Table I-1 includes inventory and survey database boiler counts for each control device and preliminary rankings of these devices. Table I-2 groups the control devices from

Table I-1 into similar control types (e.g., fabric filters, cyclones). Table I-3 is a list of control devices and control combinations effective at reducing HAP emissions from boilers.

Notes:

- The rankings of the control technologies are based on the experience of the control technology task group members and not on detailed control efficiency data.
- These control devices and combinations were put into a hierarchy for use in identifying costing algorithms by the Economics Task Group. The rankings were also used to illustrate potential preliminary MACT floor levels of control (see boiler work-in-progress posting summarizing preliminary MACT floor analyses). A more rigorous analysis using emissions data and considering detailed control and fuel information for each boiler will be necessary to develop actual MACT floor analyses.
- The rankings in Table I-3 are based on the information in Table I-2. During the development of Table I-3, a single control device outlier within a control group in Table I-2 was ignored if there were more than three controls in that group. If there was an outlier and three or less controls within that group, or if there was more than one outlier in a group, a range was assigned for the ranking (e.g., 1-2).
- When ranking a control combination, the highest ranking control within a combination was used (i.e., if a fabric filter has a ranking of 1 for metals and a cyclone is given a ranking of 4 for metals, the fabric filter/cyclone combination has a 1 ranking for metals).
- An asterisk indicates that the control device must be used in combination with another control.

Table I-1.Control Device Rankings

Control Cont				1	Solid M	laterials			Liquid N	Materials			Gas M	aterials		Inventory	/ Database	Survey Database	
Control Device Device Device Device Device Device Device Device Device Sequented O.000 O.0000 O.0000				Organio		Inorganio		Organia	,			Organio					Percent of		Percent of
No Equipment (00) (Not Southber High Efficiency (01) (12) (13) (14) (15) (16	Control Device Description		GCP		Mercury		Metals		Mercury		Metals		Mercury		Metals				
Ned Scribber High Efficiency 001				11741 0	Wordary	11/11 0	Wiotalo	11/11/0	Wichouty	11741 0	Wictard	11/11/0	Morodry	11/11/0	Motalo				
Mod Scrubbert Medium Efficiency						2	2			2	2					-,			
West Scrubber Low Efficiency 000 2 2 3 2 3																	1		
Survey Collection High Efficiency 004 4 4 4 114 0.16% 65 2.89% 65 2.89% 67 67 67 67 67 67 67 6	,									1									
Gravity Collection Medium Efficiency						2				2									
Granty Collection Low Efficiency 006 4																			
Centrilege Collection Mejor Efficiency																			
Centrings Collection Medium Efficiency																			
Centring Collection Low Efficiency																			
Electrostate Preopistater Verlight Efficiency 010																			
Electrostatic Precipitator Medium Efficiency 011																			
Electrosatic Precipitator Low Efficiency																			
Gas Scrubber, General 013																			
MSE Eliminator Lipin Velocity 015										_	_			_	_				
Mast Eliminator Low Velocity 016						2				2				2	3				
Fabric Flier High Temperature 016																			
Fabric Filter Low Temperature																			
Fabric Filter Low Temperature							•												
Catalytic Alterburner - Heat Exchange																			
Catalytic Afterburner - Heat Exchange						4	1			4	1								0.0.,0
Direct Flame Afterburner Q21	,																		
Direct Flame Afterburner - Heat Exchange 0.022																			
Flaring																			
Modified Furnace/Burner Design 0.24	Ŭ																		
Staget Combustion 0.25																			
Fue Gas Recirculation	<u> </u>																		
Reduced Combustion - Air Preheat	3																		
Seam Of Water Injection 028																			
Low-Excess - Air Firing																		· ·	
Fuel Low Nitrogen Content				_				_				•						_	0.0.70
Air Injection			X	3				3				3							
Ammonia Injection 032																			
Control Of % O2 In Combustion Air																			
Wellman-Lord/Sodium Sulfite Scrubber 034 4 2 3 4 2 3 0 0.00% 3 0.14% Magnesium Oxide Scrubbing 035 4 1 3 4 1 3 5 0.01% 0 0.00% Dual Alkali Scrubbing 038 4 1 3 4 1 3 5 0.01% 0 0.00% Ammonia Scrubbing 038 - - - - - 0 0.00% 3 0.14% Catalytic Oxidation-Flue Gas Desulfurization 039 - 1 3 1 3 1 3 7 0.01% 0 0.00% Alkalized Alumina 040 4 1 3 4 1 3 1 1 3 7 0.01% 0 0.00% Dry Limestone Injection 041 4 1 * 4 1 * * 1 1 0 0.00%				_				_				•							
Magnesium Oxide Scrubbing 035 4 1 3 4 1 3 4 1 3 5 0.01% 0 0.00% Dual Alkali Scrubbing 036 4 1 3 4 1 3 5 0.01% 0 0.00% Ammonia Scrubbing 038 8 8 8 1 3 4 1 3 5 0.01% 0 0.00% Alkalized Alumina 040 4 1 3 4 1 3 7 0.01% 0 0.00% Dry Limestone Injection 041 4 1 3 4 1 3 1 3 12 0.02% 0 0.00% Dry Limestone Injection 041 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * * 5 0 0.00% 0 0.0			X	3	4	_	2	3	4	_	_	3		_	_				
Dual Alkali Scrubbing																			
Ammonia Scrubbing 038																			
Catalytic Oxidation-Flue Gas Desulfurization 039 1 3 1 3 7 0.01% 0 0.00% Alkalized Alumina 040 4 1 3 4 1 3 1 3 12 0.02% 0 0.00% Dry Limestone Injection 041 4 1 * 4 1 * 50 0.07% 0 0.00% Wet Limestone Injection 042 4 1 * 4 1 * 16 0.02% 0 0.00% Wet Limestone Injection 042 4 1 * 4 1 * 16 0.02% 0 0.00% Sulfur Plant 045					4	1	3		4	1	3		4	1	3				
Alkalízed Alumina 040 4 1 3 4 1 3 4 1 3 12 0.02% 0 0.00% Dry Limestone Injection 041 4 1 * 4 1 * 50 0.07% 0 0.00% Wet Limestone Injection 042 4 1 * 4 1 * 16 0.02% 0 0.00% Sulfur Plant 045 9 0 0 0 0 0.00% 0 0.00% Process Change 046 9 0 0 0 0 0.00% 0						4	2			4	2			_	_				
Dry Limestone Injection					4				4				4		_				
Wet Limestone Injection 042 4 1 * 4 1 * 16 0.02% 0 0.00% Sulfur Plant 045 12 0.02% 0 0.00% Process Change 046 30 0.04% 0 0.00% Vapor Recovery System 047 19 0.03% 0 0.00% Activated Carbon Adsorption 048 2 1 4 1 4 1 10 0.01% 0 0.00% Liquid Filtration System 049 3 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0.00% 0 0										1			4	Į.	3				
Sulfur Plant 045 12 0.02% 0 0.00% Process Change 046 30 0.04% 0 0.00% Vapor Recovery System 047 19 0.03% 0 0.00% Activated Carbon Adsorption 048 2 1 4 1 4 1 10 0.01% 0 0.00% Liquid Filtration System 049 3 0.00% 0<							*				*								
Process Change 046 30 0.04% 0 0.00% Vapor Recovery System 047 19 0.03% 0 0.00% Activated Carbon Adsorption 048 2 1 4 1 4 1 10 0.01% 0 0.00% Liquid Filtration System 049 5 3 0.00% 0 0	1			1	4				4	-									
Vapor Recovery System 047 19 0.03% 0 0.00% Activated Carbon Adsorption 048 2 1 4 1 4 1 10 0.01% 0 0.00% Liquid Filtration System 049 3 0.00% 0 0.00%			1																
Activated Carbon Adsorption 048 2 1 4 1 4 1 10 0.01% 0 0.00% Liquid Filtration System 049 3 0.00% 0 0.00% Packed-Gas Absorption Column 050 1 4 1 4 3 1 10 0.01% 0 0.00% Tray-Type Gas Absorption Column 051 1 4 1 4 3 1 11 0.02% 2 0.09% Spray Tower 052 2 3 2 3 10 0.01% 3 0.14% Venturi Scrubber ² 053 2 3 2 3 126 0.18% 88 4.12%			 	1						1					-				0.00,0
Liquid Filtration System 049 3 0.00% 0 0.00% Packed-Gas Absorption Column 050 1 4 1 4 3 1 10 0.01% 0 0.00% Tray-Type Gas Absorption Column 051 1 4 1 4 3 1 11 0.02% 2 0.09% Spray Tower 052 2 3 2 3 10 0.01% 3 0.14% Venturi Scrubber² 053 2 3 2 3 126 0.18% 88 4.12%				2	1			1	1			1	1					ŭ	0.0070
Packed-Gas Absorption Column 050 1 4 1 4 3 1 10 0.01% 0 0.00% Tray-Type Gas Absorption Column 051 1 4 1 4 3 1 11 0.02% 2 0.09% Spray Tower 052 2 3 2 3 10 0.01% 3 0.14% Venturi Scrubber ² 053 2 3 2 3 126 0.18% 88 4.12%					-			4	- '			- 4							
Tray-Type Gas Absorption Column 051 1 4 1 4 3 1 11 0.02% 2 0.09% Spray Tower 052 2 3 2 3 10 0.01% 3 0.14% Venturi Scrubber² 053 2 3 2 3 126 0.18% 88 4.12%				1		4	Α			4	1			2	4		1		
Spray Tower 052 2 3 2 3 10 0.01% 3 0.14% Venturi Scrubber² 053 2 3 2 3 126 0.18% 88 4.12%			1			1									1				
Venturi Scrubber ² 053 2 3 2 3 126 0.18% 88 4.12%				1		2								3	'				
	_ ' '			1															
	Process Enclosed	053	<u> </u>				3				3					9	0.18%	0	0.00%

Table I-1.Control Device Rankings

				Solid M	laterials			Liquid N	/laterials		<u> </u>	Gas M	aterials		Inventory	/ Database	Survey Database	
Outside State	Control Device Code	GCP	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Combustor Count	Percent of	Combustor Count	Percent of Total Combustors
Control Device Description		GCP	HAPS	Mercury			HAPS	Mercury	HAPS		HAPS	Mercury	HAPS	wetais				
Impingement Plate Scrubber	055				4	4				4					7	0.01%	0	0.00%
Dynamic Separator (Dry)	056					4				4					4	0.01%	0	0.00%
Dynamic Separator (Wet) ³	057				4	4			4	4					1	0.00%	1	0.05%
Mat or Panel Filter	058														6	0.01%	0	0.00%
Metal Fabric Filter Screen	059														3	0.00%	1	0.05%
Process Gas Recovery	060														5	0.01%	0	0.00%
Dust Suppression-Water Spray Vapor Space Tank	061														10	0.01%	0	0.00%
Dust Suppression- Chem Stabilization/Wet Agents	062														2	0.00%	0	0.00%
Gravel Bed Filter Roof Tank	063														17	0.02%	7	0.33%
Catalytic Reduction Tank	065														9	0.01%	1	0.05%
Wet Lime Slurry Scrubbing	067			4	1	*		4	1	*		4	1	*	20	0.03%	4	0.19%
Alkaline Fly Ash Scrubbing	068			4	1			4	1			4	1	*	2	0.00%	3	0.14%
Sodium Carbonate Scrubbing	069			4	1	*		4	1	*		4	1	*	5	0.01%	0	0.00%
Sodium-Alkali Scrubbing System	070			4	1			4	1			4	1	*	14	0.02%	4	0.19%
Fluid Bed Dry Scrubber	071			4	1	*		4	1	*		4	1	*	5	0.01%	2	0.09%
Tube And Shell Condenser	072														15	0.02%	0	0.00%
Refrigerated Condenser	073														1	0.00%	0	0.00%
Barometric Condenser	074														0	0.00%	1	0.05%
Single Cyclone Devices	075					4				4					133	0.19%	49	2.30%
Multiple Cyclone w/o Fly	076					2				3					868	1.25%	494	23.15%
Multiple Cyclone w/ Fly Part. Air Filter Ash Reinj.	077		4			2	4			3					143	0.21%	358	16.78%
Baffle	078					4				4					4	0.01%	22	1.03%
Dry Electrostatic Granular Filter	079					1									40	0.06%	9	0.42%
Chemical Oxidation	080														6	0.01%	1	0.05%
Chemical Reduction	081														2	0.00%	0	0.00%
Chemical Neutralization	083														0	0.00%	1	0.05%
Wet Cyclonic Separator ³	085				4	3			4	3					1	0.00%	5	0.23%
Water Curtain	086														2	0.00%	3	0.14%
Conservation Vent	088														1	0.00%	0	0.00%
Bottom Filling	089														1	0.00%	0	0.00%
Conversion To Variable	090														3	0.00%	0	0.00%
Moving Bed Dry Scrubber for EFR Tank	098														1	0.00%	4	0.19%
Miscellaneous Control Devices	099														357	0.51%	82	3.84%
High Efficiency	101														14	0.02%	6	0.28%
Catalytic Oxidizer (For CO & VOC)	200														0	0.00%	2	0.09%
Duct Sorbent Injection	201			4	2	*		4	2	*		4	2	*	1	0.00%	0	0.00%
Evaporative Cooler	202														4	0.01%	0	0.00%
Furnace Sorbent Injection (Dry)	203			4	3	*		4	3	*		4	3	*	0	0.00%	16	0.75%
Rich Burn (IC Engines Only)	205														2	0.00%	0	0.00%
Low NOx Burners	206														193	0.28%	48	2.25%
Pre-Stratified Charge With Spark Angle Adj.	208														62	0.09%	0	0.00%
Selective Non-Catalytic Red. (NH3 Or Urea Inj)	209														20	0.03%	13	0.61%
Ingnition Timing	211														0	0.00%	1	0.05%
Air To Fuel Ratio	212	х	3	1			3	1			3	1			137	0.20%	286	13.40%
Venturi Scrub., Imping. Scrub., Mist Eliminator	220	<u> </u>		1	2	2		1	3	3	1	1			0	0.00%	3	0.14%
Venturi Scrub, Imping. Scrub, Cyclones	221				2	2			3	3	Ī				6	0.01%	10	0.47%
Spray Chamber, ESP	222				1	1				2	Ī				0	0.00%	3	0.14%
Multiple Cyclone, General	253					2				3	Ī				286	0.41%	0	0.00%
Collectors, Settling Chambers, Separators-General	254					4				,					54	0.08%	0	0.00%
Fabric Filter, General	255				4	1			4	1					119	0.17%	0	0.00%
Wet Scrubber, General ²	256	<u> </u>			2	3			2	3					49	0.07%	0	0.00%
	256					2				2					113	0.07%	0	0.00%
Esp, General	257	<u> </u>				2				2					113	0.10%	U	0.00%

Table I-1.Control Device Rankings

				Solid N	laterials			Liquid N	/laterials			Gas M	aterials		Inventory Database		Survey	Database
Control Device Description	Control Device Code	GCP	Organic HAPs		Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Combustor Count	Percent of Total Combustors	Combustor Count	Percent of Total Combustors
Spray Dryer, General	261			4	1	*		4	1	*					2	0.00%	0	0.00%
Flue Gas Desulfurization, General	264			4	1	*		4	1	*					6	0.01%	0	0.00%
Over - Fire Air (OFA), General	265		3												1	0.00%	0	0.00%
Limestone Injection, General	266			4	1	*		4	1	*					34	0.05%	0	0.00%
Dry Scrubbing, General	267			4		*		4	1	*					2	0.00%	0	0.00%
Selective Catalytic Reduction (SCR)	269														19	0.03%	0	0.00%
Fuel - Low Sulfur Content	271														14	0.02%	0	0.00%
Unknown Control Device Equipment	273														20	0.03%	0	0.00%
Demister	275														1	0.00%	0	0.00%
Unspecified ⁴	300 ¹														7	0.01%	32	1.50%
No Information Provided ⁵	NA ²														36,826	52.99%	654	30.65%

¹ These rankings are based on the experience of the members of the control technology task group, not on detailed control efficiency data.

² Wet scrubbers get some control of water soluble organics, such as formaldehyde, acetaldehyde, and acrolein.

³ Cyclonic devices get some control of inorganics for coal, but these devices may not get any control of inorganics from other fuels.

⁴ Control device code 300 and all non-valid codes in the database.

⁵ Control device code in the database is blank.

⁶ Asterisk denotes that the control device must be used in tandem with another control.

Table I-2.Control Device Rankings- Sorted by effectiveness and similar controls

Control Device Cont					Solid M	aterials			Liquid M	/laterials			Gas M	aterials		Inventory Database		Survey Database	
Control Device Description									1										
Control Device Description		Control															Percent of		Percent of
Eabric Filler High, Temperature		Device		Organic		Inorganic		Organic		Inorganic				Inorganic		Combustor	Total	Combustor	Total
Eabric Filter Medium Temperature	Control Device Description	Code	GCP	HAPs	Mercury	HAPs	Metals	HAPs	Mercury	HAPs	Metals	HAPs	Mercury	HAPs	Metals	Count	Combustors	Count	Combustors
Fabric Filter Low Temperature	Fabric Filter High Temperature	016				4	1			4	1					500	0.72%	36	1.69%
Eabric Filler, General	Fabric Filter MediumTemperature	017				4	1			4	1					185	0.27%	31	1.45%
Spray Chamber ESP 222	Fabric Filter Low Temperature	018				4	1			4	1					129	0.19%	20	0.94%
Electrostatic Precipitator High Efficiency	Fabric Filter, General	255				4	1			4	1					119	0.17%	0	0.00%
Electrostatic Precipitator Medium Efficiency	Spray Chamber, ESP	222				1	1				2					0	0.00%	3	0.14%
Electrostatic Precipitator Low Efficiency	Electrostatic Precipitator High Efficiency	010					2				2					750	1.08%	241	11.29%
Dry Electrostatic Granular Filter	Electrostatic Precipitator Medium Efficiency	011					2				2					118	0.17%	33	1.55%
Esp. General 257 2 2 2 2 2 2 2 2 2	Electrostatic Precipitator Low Efficiency	012					2				2					30	0.04%	4	0.19%
Wet Scrubber High Efficiency	Dry Electrostatic Granular Filter	079					1									40	0.06%	9	0.42%
Wet Scrubber Medium Efficiency	Esp, General	257					2				2					113	0.16%	0	0.00%
Wet Scrubber Low Efficiency 2 3 2 3 3 2 3 3 2 3 3	Wet Scrubber High Efficiency ²	001				2	3			2	3					296	0.43%	67	3.14%
Wet Scrubber Low Efficiency ² 003 2 3 2 3 53 0.08% 16 0.3 Wet Scrubber, General 256 2 3 2 3 49 0.07% 0 0.0 Gas Scrubber, General 013 2 3 2 3 2 3 8 0.12% 10 0.0 Packed-Gas Absorption Column 050 1 4 1 4 3 1 10 0.01% 0 0.0 Impringement Column 051 1 4 1 4 3 1 11 0.01% 0 0.0 Impringement Plate Scrubber 055 4 4 4 3 1 11 0.01% 0 0.0 Venturi Scrub, Imping, Scrub, Mist Eliminator 220 2 2 3 3 0 0.00% 3 0.1 Venturi Scrub, Imping, Scrub, Cyclones 221 2 2 3 3 3 0	v ,											I							3.37%
Wet Scrubber, General 256 2 3 2 3 49 0.07% 0 0.0 Gas Scrubber, General 013 2 3 2 3 2 3 86 0.12% 10 0.4 Packed-Gas Absorption Column 050 1 4 1 4 3 1 11 0.01% 0 0.0 0	, ·																		0.75%
Cas Scrubber, General																			0.73%
Packed-Gas Absorption Column 050 1 4 1 4 1 4 3 1 10 0.01% 0 0.01												 	-	2	2			_	0.00%
Tray-Type Gas Absorption Column	,																		0.47%
Impingement Plate Scrubber						1				•									0.00%
Venturi Scrub., Imping. Scrub., Mist Eliminator 220 2 2 2 3 3 3 0 0.00% 3 0.00% 10 0.00						1				- 1				3	'				0.09%
Venturi Scrub, Imping. Scrub, Cyclones 221	1 0					•				2								_	
Venturi Scrubber			ļ																0.14% 0.47%
Wellman-Lord/Sodium Sulfite Scrubber 034 4 2 3 4 2 3 0 0.00% 3 0.7 Magnesium Oxide Scrubbing 035 4 1 3 4 1 3 4 1 3 5 0.01% 0 0.0 Dual Alkali Scrubbing 036 4 1 3 4 1 3 4 1 3 5 0.01% 0 0.0 Wet Lime Slurry Scrubbing 067 4 1 3 4 1 3 4 1 3 5 0.01% 0 0.0 Alkaline Fly Ash Scrubbing 068 4 1 * 4 1 * 4 1 * 4 1 * 2 0.00% 3 0.7 Sodium-Alkali Scrubbing 069 4 1 * 4 1 * 4 1 * 4 1 * 2 0.00% 0 </td <td></td>																			
Magnesium Oxide Scrubbing 035 4 1 3 4 1 3 4 1 3 5 0.01% 0 0.00 Dual Alkali Scrubbing 036 4 1 3 4 1 3 5 0.01% 0 0.00 Wet Lime Slurry Scrubbing 067 4 1 * 4 1 <																			4.12%
Dual Alkali Scrubbing 036 4 1 3 4 1 3 4 1 3 5 0.01% 0 0.00 Wet Lime Slurry Scrubbing 067 4 1 * 4 1 * 4 1 * 20 0.03% 4 0.0 Alkaline Fly Ash Scrubbing 068 4 1 * 4 1 * 4 1 * 20 0.03% 4 0.0 Sodium Carbonate Scrubbing 069 4 1 * 4 1 * 4 1 * 5 0.00% 3 0.0 Sodium-Alkali Scrubbing System 070 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4					•											_			0.14%
Wet Lime Slurry Scrubbing 067 4 1 * 4 1<	0								-	•			· -	-					0.00%
Alkaline Fly Ash Scrubbing 068 4 1 * 4 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0.00%</td></td<>																			0.00%
Sodium Carbonate Scrubbing 069						'				•				•					0.19%
Sodium-Alkali Scrubbing System 070	, ,													-					0.14%
Dry Scrubbing, General 267	<u> </u>								-	•			<u> </u>		*				0.00%
Fluid Bed Dry Scrubber 071 4 1 * 4 1 * 4 1 * 5 0.01% 2 0.0 Dry Limestone Injection 041 4 1 * 4 1 * 5 0.07% 0 0.0 Wet Limestone Injection 042 4 1 * 4 1 * 5 0.07% 0 0.0 Duct Sorbent Injection 201 4 2 * 4 1 * 5 0.00% 0 0.0 Furnace Sorbent Injection (Dry) 203 4 3 * 4 2 * 4 2 * 1 0.00% 0 0.0 Limestone Injection, General 266 4 1 * 4 1 * 4 1 * 3 * 3 * 0 0.00% 16 0.0 Catalytic Oxidation-Flue Gas Desulfurization 039 1 1 3 1 3 1 3 7 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 6 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 4 1 * 7	Ů,								-				4	1	*			· ·	0.19%
Fluid Bet Dry Scrubber 1										•									0.00%
Wet Limestone Injection 042 4 1 * 4 1 * 16 0.02% 0 0.0 Duct Sorbent Injection 201 4 2 * 4 2 * 4 2 * 1 0.00% 0 0.0 Furnace Sorbent Injection (Dry) 203 4 3 * 4 3 * 4 3 * 0 0.00% 16 0.7 Limestone Injection, General 266 4 1 * 4 1 * 4 3 * 0 0.00% 16 0.7 Limestone Injection, General 266 4 1 * 4 1 * 4 1 * 34 0.05% 0 0.0 Catalytic Oxidation-Flue Gas Desulfurization 039 1 3 1 3 1 3 7 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4	,					1							4	1	*	-			0.09%
Duct Sorbent Injection 201 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 2 * 4 3 * 4 3 * 4 3 * 4 3 * 4 3 * 4 3 * 4 3 * 4 3 * 4 3 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 * 4 1 3 1 3 <td>,</td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td>•</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0.00%</td>	,					1				•									0.00%
Solid Solider Injection 201	,								-	-						_			0.00%
Limestone Injection, General 266 4 1 * 4 1 * 34 0.05% 0 0.0 Catalytic Oxidation-Flue Gas Desulfurization 039 1 3 1 3 7 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 6 0.01% 0 0.0															*				0.00%
Catalytic Oxidation-Flue Gas Desulfurization 039 1 3 1 3 7 0.01% 0 0.0 Flue Gas Desulfurization, General 264 4 1 * 4 1 * 6 0.01% 0 0.0	, ,,,												4	3	*				0.75%
Flue Gas Desulfurization, General 264 4 1 * 4 1 * 6 0.01% 0 0.0	,				4	1			4	1								_	0.00%
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						1								1	3	•			0.00%
Spray Tower	Flue Gas Desulfurization, General				4	1	*		4	1	*							0	0.00%
	Spray Tower	052				2	3			2	3							3	0.14%
-1 -9 9 - 9 - 9 - 9 - 9 - 9 - 9 - 9 - 9	Spray Dryer, General	261			4	1	*		4	1	*						0.00%		0.00%
	Mist Eliminator High Velocity						4				4							_	0.42%
Mist Eliminator Low Velocity 015 4 4 8 0.01% 5 0.2	Mist Eliminator Low Velocity	015					4				4					8	0.01%	5	0.23%
Gravity Collection High Efficiency 004 4 4 39 0.06% 55 2.6	Gravity Collection High Efficiency	004					4				4					39	0.06%	55	2.58%
Gravity Collection Medium Efficiency 005 4 4 114 0.16% 0 0.6	Gravity Collection Medium Efficiency	005					4				4					114	0.16%	0	0.00%
Gravity Collection Low Efficiency 006 4 4 96 0.14% 0 0.6	Gravity Collection Low Efficiency	006					4				4					96	0.14%	0	0.00%
																			23.15%
	Multiple Cyclone w/ Fly Part. Air Filter Ash Reinj.			4			2	4										358	16.78%
Multiple Cyclone, General 253 2 3 286 0.41% 0 0.6	Multiple Cyclone, General	253					2				3					286	0.41%	0	0.00%
Centrifuge Collection High Efficiency 007 4 4 485 0.70% 56 2.6	Centrifuge Collection High Efficiency	007					4				4					485	0.70%	56	2.62%
																			3.05%

Table I-2. Control Device Rankings- Sorted by effectiveness and similar controls

			Solid Materials					Liquid M	/laterials			Gas M	aterials		Inventory	/ Database	Survey Database	
Control Device Description	Control Device Code	GCP	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Combustor Count	Percent of Total Combustors	Combustor Count	Percent of Total Combustors
Centrifuge Collection Low Efficiency	009					4				4					144	0.21%	19	0.89%
Dynamic Separator (Dry)	056					4				4					4	0.01%	0	0.00%
Dynamic Separator (Wet) ³	057				4	4			4	4					1	0.00%	1	0.05%
Wet Cyclonic Separator ³	085				4	3			4	3					1	0.00%	5	0.23%
Single Cyclone Devices	075					4				4					133	0.19%	49	2.30%
Collectors, Settling Chambers, Separators-General	254					4									54	0.08%	0	0.00%
Low-Excess - Air Firing	029	Х	3				3				3				116	0.17%	76	3.56%
Control Of % O2 In Combustion Air	033	х	3				3				3				118	0.17%	0	0.00%
Air To Fuel Ratio	212	х	3				3				3				137	0.20%	286	13.40%
Over - Fire Air (OFA), General	265		3												1	0.00%	0	0.00%
Baffle	078					4				4					4	0.01%	22	1.03%
Activated Carbon Adsorption	048		2	1			4	1			4	1			10	0.01%	0	0.00%
Alkalized Alumina	040			4	1	3		4	1	3		4	1	3	12	0.02%	0	0.00%

¹ These rankings are based on the experience of the members of the control technology task group, not on detailed control efficiency data.

² Wet scrubbers get some control of water soluble organics, such as formaldehyde, acetaldehyde, and acrolein.

³ Cyclonic devices get some control of inorganics for coal, but those devices may not get any control of inorganics from other fuels.

⁴ Asterisk denotes that the control device must be used in tandem with another control.

Table I-3. Control Device Rankings for Economics Analysis

(1=most effective, 4 = least effective)¹

		Solid M	laterials		Liquid N	/laterials			Gas M	aterials		Inventory	Database	Survey Database		
Control Device Description	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Organic HAPs	Mercury	Inorganic HAPs	Metals	Combustor Count	Percent of Total Combustors	Combustor Count	Percent of Total Combustors
Fabric Filter			4	1			4	1					933	1.34%	87	4.08%
ESP				1-2				2					1,051	1.51%	290	13.59%
Packed-tower gas absorber			1	4			1	4			3	1	10	0.01%	0	0.00%
Venturi scrubber ²			2	2-3			3	3					132	0.19%	101	4.73%
Scrubbers (no detail) ²			2	3			2	3					739	1.06%	167	7.83%
Scrubbers - acid gas		4	1	*-3		4	1	*-3		4	1	*-3	71	0.10%	16	0.75%
Cyclones ³			4	2-4			4	3-4					3,085	4.44%	1,102	51.64%
Activated carbon adsorption	2	1			4	1			4	1			10	0.01%	0	0.00%
Dry injection		4	1-3	*		4	1-3	*		4	3	*	50	0.07%	16	0.75%
Wet injection		4	1-2	*		4	1-2	*		4	2	*	51	0.07%	0	0.00%
GCP	3				3				3				372	0.54%	362	16.96%
Wet injection/fabric filter		4	1-2	1		4	1-2	1		4	2	*	38	0.05%	0	0.00%
Wet injection/ESP		4	1-2	1-2		4	1-2	2		4	2	*	11	0.02%	0	0.00%
Cyclones/fabric filter ³			4	1			4	1					229	0.33%	34	1.59%
Cyclones/ESP ³			4	1-2			4	2					295	0.42%	180	8.43%
Cyclone/acid gas scrubber		4	1	2-4		4	1	3-4					12	0.02%	8	0.37%
Cyclone/venturi or no detail scrubber			2	2-3			2	3					318	0.46%	150	7.03%
Cyclone/absorber			1	2-4			1	3-4					6	0.01%	0	0.00%
Cyclone/ESP/acid gas scrubber		4	1	1-2		4	1	2					7	0.01%	3	0.14%
Cyclone/ESP/venturi or no detail scrubber			2	1-2			2	2					8	0.01%	10	0.47%
Cyclone/ESP/absorber			1	1-2			1	2					2	0.00%	0	0.00%
Dry injection/fabric filter		4	1-3	1		4	1-3	1		4	3	*	36	0.05%	15	0.70%
Dry injection/ESP		4	1-3	1-2		4	1-3	2		4	3	*	14	0.02%	1	0.05%
Acid gas scrubber/ESP		4	1	1-2		4	1	2		4	1	*-3	14	0.02%	5	0.23%
Acid gas scrubber/fabric filter		4	1	1		4	1	1		4	1	*-3	30	0.04%	3	0.14%

¹ These rankings are based on the experience of the members of the control technology task group, not on detailed control efficiency data.

Note: The preliminary costing data will be based on the information in this table. This table will also be used to give WG members an idea of what the preliminary MACT floor may be. The MACT floor will be determined using more rigorous analyses and emissions data.

² Wet scrubbers get some control of water soluble organics, such as formaldehyde, acetaldehyde, and acrolein.

³ Cyclonic devices get some control of inorganics for coal, but those devices may not get any control of inorganics from other fuels.

⁴ Asterisk denotes that the control device must be used in tandem with another control.